June 10, 1941. M. PASCALE 2,244,800

HEAT TRANSFER TUBE

Filed Dec. 26, 1939

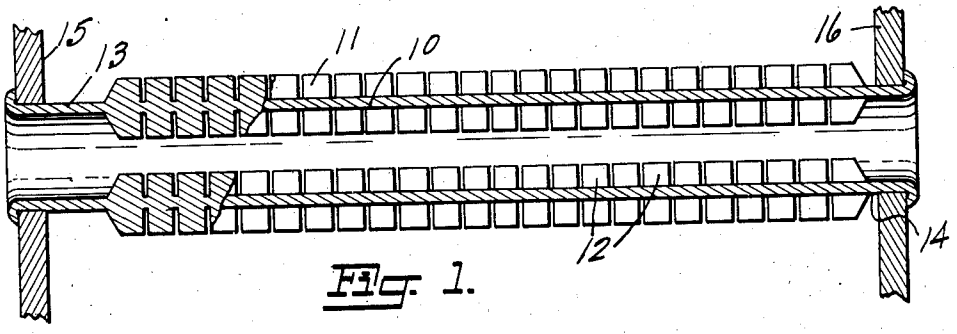


Fig. 1.

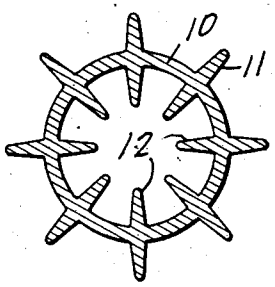


Fig. 2.

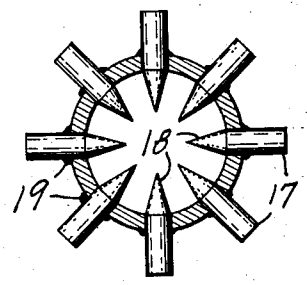


Fig. 3.

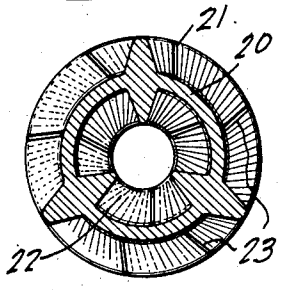


Fig. 4.

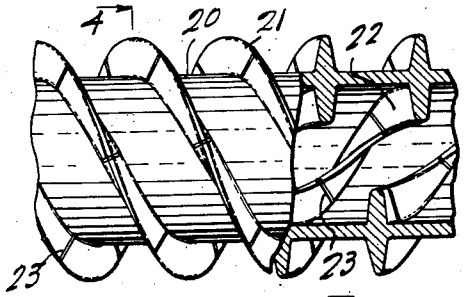


Fig. 5.

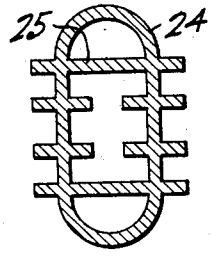


Fig. 6.

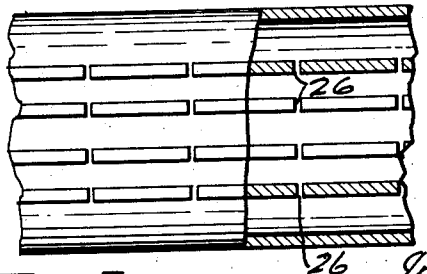


Fig. 7.

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HEAT TRANSFER TUBE

Miguel Pascale, Oakland, Calif.

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1 Claim. (Cl. 257—262)

This invention, a heat transfer tube, is designed for use under conditions in which heat is to be transferred from one fluid to another, such as in fire-tube or water-tube boilers, water heaters, refrigeration, and radiators of heating systems.

The main object of the invention is to provide a tube which will effect an absolute maximum in heat transfer as related to the volume and capacity of the tube.

Another object of the invention is to provide a tube with integral webs or fins to increase the superficial heat transfer area over that of the plain tube.

A further object of the invention is to provide a tube for transfer of heat with both, inner and outer fins or webs and so proportioned as to provide equalization of heat transfer between the inside and the outside of the tube.

A still further object of the invention is to form the additional heat transfer elements, such as the fins or webs, in comparatively short sections to prevent introduction of stresses through uneven heating of inner elements relative to the exterior elements.

Other objects and advantages of the invention will become apparent as the following description is read on the drawing forming a part of this specification, and in which similar reference characters are used to designate similar parts throughout the several views, of which:

Fig. 1 is a longitudinal section through a boiler tube with the invention applied thereto.

Fig. 2 is a cross-sectional view showing a modification as to the number of fins as related to Fig. 1.

Fig. 3 is a modification of Fig. 2, showing pins substituted for the plate fins of the other types.

Fig. 4 is another modification in which the fins are formed spirally within and exteriorly of the tube.

Fig. 5 is a fragmentary longitudinal view of Fig. 4 with a portion shown in section to illustrate the interior construction.

Fig. 6 is a modification showing the invention applied to a noncircular type of tubing.

Fig. 7 is a fragmentary longitudinal view of Fig. 6, and is shown partly in section.

The invention consists in forming heat transfer tubing such as fire tubes, water tubes, steam radiators, refrigerating coils, and water heating coils, with integral heat-transfer elements, for the purpose of increasing the efficiency of the tubes to establish heat transfer at an absolute maximum without increasing the normal area of the tube or the space normally required for installation.

The tube 10 is provided with heat transfer elements 11 and 12 respectively externally and internally, and these elements are preferably balanced to provide equal superficial areas so as to maintain directly relative heat transfer characteristics irrespective of variations in exterior and interior temperatures. These elements are formed as an integral part of the tube, by either direct rolling or casting processes, or through welding processes, so that the fins, webs or pins and the tube will be an inseparable and directly conductable unit.

These webs or fins in all cases are divided into short sections as shown so as to be ineffective in setting up stresses through contraction or expansion created by heat and the ends 13 and 14 of the tubes for boilers or similar uses are left free of heat transfer elements to permit installation in the flue sheets or boiler heads 15 and 16.

Fig. 2 is identical to Fig. 1, with the exception that eight sets of equi-angularly spaced radial heat transfer fins are included instead of two as shown in Fig. 1. The number of fins is governed principally by the diameter of the tube.

Fig. 3 can be made with fins in the form of pins in any desired shape, and these pins are shown as cylindrical externally and conical internally, although wedge or any other shape may be employed. This figure illustrates a conventional tube with a multiplicity of holes punched or drilled and pins inserted and welded in place as indicated at 19, the exterior portion 17 of the pins being made to fit the holes. Instead of conical, the interior portions 18 of these pins may also be cylindrical in form.

Figs. 4 and 5 show the invention applied as a series of spiral elements 21 formed exteriorly, and 22 formed interiorly of the tube 20. These spiral elements are formed similarly to the other elements, either integral with the tube as by rolling or casting, or by welding such as by a continuous butt-weld process. The spirals, similar to the straight type of fins, are divided into short sections as shown at 23 so as to eliminate the possibility of creation of torsional stresses. Rings can be substituted for spirals.

Figs. 6 and 7 show a structure similar to Fig. 1 with the exception that in these figures the invention is applied to non-circular tubing 24 and includes tie fins 25 interiorly which act as a tie between the bulgable walls, but which tie fins, due to the formation of the slots 26 permits com-

munication throughout the cross-sectional area of the tube.

It will be understood that variations in construction and arrangement of parts, which variations are consistent with the appended claim may be resorted to without detracting from the spirit or scope of the invention or sacrificing any of the advantages thereof.

I claim:

A boiler tube substantially elliptical in cross-section and having internal webs parallel to the minor axis of the tube and spaced on opposite sides thereof for heat transfer and for tying the opposite walls of the tube together and with said webs formed in short sections and longitudinally spaced to provide fluid passages between the chambers formed on opposite sides of the webs; and fins located internally between said webs and formed in short sections spaced longitudinally and extending throughout the length of the tube, and similar fins located externally of said tube to provide external heat transfer means, said short sections compensating for thermal expansion and contraction.

MIGUEL PASCALE.